passed before I measured it, and it is only recently that second and third measures have been obtained. These measures give —

1900.920	22°.7	0″.26	5.8	6.0
1901.584	205 .3	0 .24	6.0	6.0
.658	23 .6	0 .25	6.0	6.0

The magnitudes of the two components are so nearly the same that I have not been able to determine the quadrant with certainty.

66 Tauri is a naked-eye star. Its proper motion has been determined, and, according to AUWERS, is given by the equations —

$$\mu = -0^s.0027, \qquad \mu' = -0''.004.$$

On account of the character of the pair and by reason of its proper motion, it is probable that *66 Tauri* is a binary.

I have recently found the principal component of Σ 2339 to be a close pair. The star did not appear to be quite round to me with the 12-inch telescope. On this account I examined it with the 36-inch refractor, which clearly showed it double. I have made the following measures of it:—

1901.603	85°.2	0″.20	8.0	8.2
.608	87 .0	0 .18	. .	. .
.623	86 .7	0 .20	8.0	8.2

The components of this pair are a little unequal in brightness, so that the quadrant is readily determinable.

I have referred these stars to Professor BURNHAM, who has kindly looked them up for me, and states that they are both new.

W. J. HUSSEY.

OBSERVATIONS OF THE SPECTROSCOPIC BINARY *η PEGASI*.*

The binary character of *η Pegasi* was discovered in August, 1898, from observations made with the Mills spectroscope, and announced in the *Astrophysical Journal* for October, 1898. It was the first one of some thirty-five spectroscopic binary systems discovered in the past three years with this efficient instrument. As a basis for determining the orbit of the bright component of

* From Lick Observatory Bulletin, No. 5

this system, the following velocities in the line of sight were observed:—

No.	Date. Greenwich M. T.	Velocity. Kms.	No.	Date. Greenwich M. T.	Velocity. Kms.
1	1896, Aug. 27 8,	+ 7 10	16	1899, June, 21.0,	— 8.02
2	Sept. 23.7,	+ 5 10	17	27.0,	— 8.31
3	1897, July 8 9,	— 6.37	18	July, 26.9,	— 7.14
4	Sept. 28.7,	— 2.21	19	Sept. 6.8,	— 6 81
5	1898, Aug. 29.8,	+16.54	20	Dec. 19.7,	— 3 86
6	30.8,	+15.62	21	25.7,	— 1.44
7	Sept. 4.7,	+16.46	22	1900, May, 14 0,	+10 89
8	15.8,	+15 74	23	June, 7 0,	+14 06
9	Oct. 18.7,	+10.99	24	Aug. 1.9,	+18.89
10	24 8,	+11 51	25	Sept. 25.7,	+21 40
11	26.8,	+10.83	26	Oct. 9 7,	+20.37
12	Nov. 28 7,	+ 6.06	27	24 8,	+19 88
13	1899, Jan. 23.6,	— 0.84	28	Dec. 11.7,	+15.17
14	May, 2.0,	— 6 44	29	1901, May, 9.0,	— 0.18
15	9.0,	— 5 94			

The period of revolution of the system was early found to be about two years and a quarter. The observations are distributed over more than two complete periods.

The probable error of one observation, $\pm$ 0.47 kilometer, determined by Dr. CRAWFORD, is very satisfactory under the circumstances. It is based upon all the observations secured. These include those made in 1896, with a very imperfect camera lens. The first thirteen observations were obtained before the special temperature control was installed. The thirteenth observation was made when the star was low in the west, in the early evening, with the temperature changing rapidly. Experience has shown that observations taken under such conditions are not only useless, but are apt to be harmful, and No. 13 might well have been rejected. It furnishes the largest residual, and its rejection would have reduced very materially the computed probable error of a single observation.

The spectra were measured, in all cases, soon after they were secured, in six different years. The 26th, 27th, and 28th plates were measured and reduced by Dr. REESE, and the remaining twenty-six plates by myself. If they could have been measured in quick succession, by one observer, no doubt the results would yield a much smaller computed probable error, as the personal habits of measurement change appreciably with time.

Messrs. HUSSEY and AITKEN have carefully examined η *Pegasi* with the 36-inch refractor, but have been unable to detect the companion-star.

W. W. CAMPBELL.

1901, July 24.

THE ORBIT OF THE SPECTROSCOPIC BINARY η *PEGASI.*

[ABSTRACT.]*

This orbit of η *Pegasi* is based upon the twenty-nine observations given by Director CAMPBELL. Of these, several groups have been formed into normal positions by taking the mean of their dates and of their velocities. These groups are Nos. 5, 6, 7, 8; 9, 10, 11; 14, 15; 16, 17; and 20, 21. All of the other observations have been given weight unity, except No. 13, to which, for reasons given by Director CAMPBELL, weight one-half has been assigned.

From the plot of these observations the first approximation to the period was taken to be 815 days. By adjusting the upper and the lower areas to equality by means of a planimeter, the velocity of the center of the mass was found to be $+4.15^{km}$.

Using the formulæ and notation of LEHMANN–FILHÉS, a set of preliminary constants and elements was obtained. From these elements and the residuals resulting from them twenty-one weighted homogeneous observation equations were set up. These were solved by the method of Least Squares and a second set of elements obtained. From the differences between the residuals as found from these elements and from the observation equations, it was seen that the terms involving the second powers of the increments in the differential equations of condition were not negligible. This discrepancy necessitated another solution starting from the second elements, which resulted in the set of Final Elements here given :—

FINAL ELEMENTS.

$K =$	14.20^{km}	$\pm 0.13^{km}$
$e =$	0.1548	± 0.0106
$\omega =$	$5^{\circ}.605$	$\pm 3^{\circ}.708$
$\mu =$	0.007681 rad	± 0.000020 rad
$=$	$0^{\circ}.44009$	$\pm 0^{\circ}.00117$
$T =$	1898 June 29.7	± 8.1 days
$=$	1900 Sept 25.7	
$V_0 =$	$+4.31^{km}$	$\pm 0.10^{km}$
$U =$	818.0 days	± 2.2 days
$a \sin i =$	157,800,000	

RUSSELL TRACY CRAWFORD.

* The detailed paper is printed in *Bulletin* No. 5 of the Lick Observatory.